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DECORATIVE ILLUMINATED ARTICLE
ADAPTED FOR USE WITH A LIGHTING STRING

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BACKGROUND

Traditional lighting strings include a plurality of light bulb assemblies arranged in spaced intervals along the length of a wire. When the lighting string is connected to a power source, the light bulbs are illuminated, thereby providing a decorative effect. Since the light bulbs assemblies are in close proximity to the wire, the decorative light is also centralized around the wire.

Various decorative ornaments are known in the art. Some ornaments are provided with an electrical cord or a battery to provide an illuminating effect on the ornament. Such ornaments, while visually pleasing, are often limited in use because the ornament must be placed in close proximity to the power source such as an electrical outlet. Even where a battery is used, the ornament must be positioned in a location, for example, on a tree, where the

battery pack will be concealed. While battery-operated ornaments provide an advantage over the corded ornaments, such ornaments require maintenance as the battery has a limited life. Thus, there is a need for an improved means of providing an ornament that can be illuminated for an extended period of time
5 without the need for a separate source of electrical power.

Some improved ornaments have been disclosed in U.S. Patent No. 4,544,218 to Sanders et al. and U.S. Patent No. 6,612,864 to Hsu. While such ornaments provide an advantage over the prior battery operated devices, there remains a need for improved ornamental devices with additional features to
10 enhance flexibility and usability of the illuminated article.

SUMMARY OF THE INVENTION

The present invention generally relates to a decorative illuminated article adapted for use with a conventional lighting string.

15 According to a first aspect of the present invention, the decorative illuminated article includes a wiring assembly including a length of wire having a first end and a second end, the first end connected to a male insert, the second end connected to a lighting assembly, a hollow enclosure including a decorative element contained therein and a neck adapted to receive the lighting
20 assembly, and a clip attached to the wire for receiving a light bulb from the lighting string. The clip may be removably attached to the wire for selective placement along the length of the wire.

In one variation of the first aspect of the present invention, the clip includes at least two substantially parallel segments connected at one end and
25 having a circular void therebetween. The void is dimensioned to receive a light bulb. As such, the segments are sufficiently flexible to be partially and temporarily separated to receive a light bulb within the void.

In another variation of the first aspect of the present invention, the clip includes a first segment and a second segment, the first segment and the second segment joined at one end, and a first void and a second void formed between the first segment and the second segment. The first void is
5 dimensioned to receive a wire, and the second void is dimensioned to receive a light bulb.

In another variation of this aspect, the lighting assembly includes a plurality of light emitting diodes (LEDs) and a base for supporting the plurality of LEDs.

10 According to a second aspect of the present invention, the decorative illuminated article includes a wiring assembly including a length of wire having a first end and a second end, the first end connected to a male insert, the second end connected to a lighting assembly, a hollow enclosure including a decorative element contained therein and a neck having an opening sized to
15 receive the lighting assembly, and a collar having a hole through which the wire is inserted, the collar slidably positioned between the first end and the second end and having an interior surface adapted to receive the neck.

In one variation of the second aspect of the present invention, the article further includes a threaded gasket positioned around the neck. In such a
20 variation, the interior surface of the collar is adapted to threadably receive the neck.

In a second variation of the second aspect of the present invention, the article further includes a clip removably attached to the wire, the clip including at least one circular void dimensioned to receive a light bulb from the lighting
25 string.

In a third variation of the second aspect, the lighting assembly includes a plurality of LEDs and a base for supporting the plurality of LEDs.

According to a third aspect of the present invention, a decorative illuminated article adapted for use with a lighting string includes a wiring assembly including a length of wire having a first end and a second end, the first end connected to a male insert and the second end connected to a lighting assembly, the male insert including a base and a husk, the husk including a pair of resilient tabs having a fixed end flexibly attached to and extending angularly from opposed sides of the husk in a coaxially aligned spaced apart relation, where each tab is adapted to deflect in a direction toward the opposed tab upon application of a biasing force and protrude in a direction away from the opposed tab upon removal of the biasing force, and a hollow enclosure including a decorative element contained therein and a neck having an opening sized to receive the lighting assembly. The use of one of more resilient tabs enables the male insert to fit into a plurality of different sized sockets of various lighting strings. In one variation of this aspect, the lighting assembly includes a plurality of LEDs and a base for supporting the plurality of LEDs.

According to a fourth aspect of the present invention, a decorative illuminated article includes a wiring assembly including a length of wire having a first end connected to a male insert and a second end connected to a lighting assembly, the lighting assembly including a plurality of LEDs and a base for supporting the plurality of LEDs, a hollow enclosure including a decorative element contained therein and a neck having an opening for receiving the lighting assembly, a threaded gasket fittedly positioned around the neck, a collar having a hole through which the wire is inserted, the collar slidably positioned between the first end and the second end and having an interior surface adapted to threadably receive the neck, and a clip removably attached to the wire, the clip including a circular void dimensioned to receive a light bulb from a lighting string.

In one variation of this aspect, the lighting assembly includes a plurality of LEDs and a base for supporting the plurality of LEDs.

In another variation of this aspect, the male insert includes a base and a husk, where the husk includes a pair of resilient tabs having a fixed end flexibly
5 attached to and extending angularly from opposed sides of the husk in a coaxially aligned spaced apart relation, and each tab is adapted to deflect in a direction toward the opposed tab upon application of a biasing force and protrude in a direction away from the opposed tab upon removal of the biasing force.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts an exemplary decorative illuminated article according to the present invention.

FIG. 2 depicts an exemplary enclosure that may be used in accordance
15 with the present invention.

FIG. 3 depicts a wiring assembly according to the present invention in relation to a lighting string and decorative enclosure.

FIG. 4 depicts an exemplary universal fit male insert that may be used in accordance with the present invention.

FIG. 5A depicts another exemplary male insert that may be used in
20 accordance with the present invention.

FIG. 5B depicts removal of the husk from an exemplary male insert for adaptation with conventional lighting strings.

FIG. 6 depicts removal of a husk from a lighting string for use with the
25 wiring assembly of the present invention.

FIG. 7A depicts a side plan view of exemplary lighting assembly that may be used in accordance with the present invention.

FIG. 7B depicts a bottom plan view of an exemplary circuit board supporting multiple LEDs in accordance with the present invention.

FIG. 8A depicts a perspective view of an exemplary collar that may be used in accordance with the present invention.

5 **FIG. 8B** depicts a perspective view of the interior of an exemplary collar that may be used in accordance with the present invention.

FIG. 8C depicts an exemplary collar that may be used with the present invention threadably engaging an exemplary decorative enclosure.

10 **FIG. 9A** depicts an exemplary clip for use in accordance with the present invention.

FIG. 9B depicts an exemplary clip having two voids for receiving a wire and a light bulb for use in accordance with the present invention.

15 **FIG. 9C** depicts an exemplary clip having three voids for receiving two individual wires and a light bulb for use in accordance with the present invention.

FIG. 9D depicts an exemplary clip having three voids for receiving two individual wires and a light bulb, and an integral end for structural integrity for use in accordance with the present invention.

20 DETAILED DESCRIPTION OF THE INVENTION

The present invention relates generally to a decorative illuminated article that is adapted for use with a lighting string. The decorative illuminated article is capable of being removably attached to any position on a lighting string, thereby affording the user considerable flexibility in positioning the article on
25 the lighting string, for example, on a holiday tree.

As depicted in **FIG. 1**, an exemplary decorative illuminated article 20 according to the present invention includes a wiring assembly 22 including a

length of wire 24 having a first end 26 and a second end 28, where the first end 26 is connected to a male insert 30, and the second end 28 is connected to a lighting assembly 32. An article 20 according to the present invention further includes a hollow enclosure 34 containing a decorative element 36 therein and a neck 38 (best seen in FIGs. 2, 3, and 8) adapted to receive the lighting assembly 32. An article 20 according to the present invention may further include a collar 40 for securing the wiring assembly 22 to the enclosure 34. An article 20 according to the present invention may further include a clip 42 for holding a light bulb 44 from a conventional lighting string 46.

The wiring assembly 22 is adapted to be connected to a conventional lighting string 46. As is known to those of skill in the art, a conventional lighting string 46 typically includes an AC plug (not shown), a length of electrical wiring 50, and a plurality of sockets 52 for receiving a light bulb 44 in a spaced relation along the length of the wiring 50. To provide power to the lighting assembly 32 and illuminate the decorative article 20, the male insert 30 of the wiring assembly 32 is inserted into an empty socket 52 of the lighting string 46. Thus, the user of the illuminated article 20 of the present invention can select any location to hang the article 20 along the lighting string 46, for example, on a Christmas tree, mantle, window frame, and so forth, without having to be limited by placing the article 20 near an additional power source.

FIG. 2 depicts an exemplary enclosure 34 that may be used with the present invention. The enclosure 34 may be formed from any suitable material, including, but not limited to, plastic, glass, and so forth. The enclosure 34 may be transparent, translucent, partially opaque, colorless, or colored as desired. The enclosure 34 may have any shape, and in some instances, the enclosure 34 has a generally spherical shape. In other instances, the enclosure 34 may have

an oblong shape (not shown). In some instances, the enclosure 34 may include a flattened or concave (not shown) bottom 54.

5 The enclosure 34 includes a neck 38. The neck 38 is generally cylindrical in shape and includes a circular opening 56. The opening 56 is sized to receive at least a portion of the lighting assembly 32. The neck 38 may further include a threaded gasket 58 positioned around the exterior of the neck 38. The gasket 58 may typically be formed from a flexible or elastomeric material, such as rubber, so that the gasket 58 fits securely around the neck 38.

10 The enclosure 34 may include a decorative element 36 made from any suitable material in any shape desired. Some examples of decorative elements 36 include a Christmas tree, reindeer, angel, snowflake, snowman, Santa Claus, poinsettia, candle, manger scene, and so forth. In some embodiments, the enclosure 34 may have a flat bottom 54 to provide a platform to place the decorative element 36. In other embodiments, the decorative element 36 may
15 be suspended (not shown) from the neck 38 to create a floating or rotating effect in the enclosure 34.

Turning to **FIGs. 3-7**, various aspects of a wiring assembly 22 according to the present invention are illustrated. The wiring assembly 22 includes a length of wire 24 having a first end 26 and a second end 28 (**FIG. 3**). The first
20 end 26 is connected to a male insert 30, further described in connection with **FIGs. 4-6**. The second end 28 is connected to a lighting assembly 32, described in greater detail in connection with **FIGs. 7A-7B**.

FIG. 3 further depicts an exemplary collar 40 according to the present invention, discussed in greater detail in connection with **FIGs. 8A-8C**.
25 According to one aspect of the present invention, the collar 40 is an individual component that may be slidably positioned between the first end 26 and the second end 28, independent from the lighting assembly 32. The collar 40

includes an interior space **62** (best seen in **FIG. 8B**) dimensioned to receive the lighting assembly **32**. According to another aspect of the invention (not shown), the collar **40** is integral with the lighting assembly **32** and is fixedly positioned at the second end **28** of the wire **24**.

5 As illustrated in **FIG. 4**, the male insert **30** generally includes a cylindrical base **64** and a husk **66**. The male insert **30** includes a pair of bendable wire leads **68** that extend from an insertable end **70** of the male insert **30**. As is understood by those skilled in the art, the wire leads **68** extend outwardly from and are bent over the insertable end **70** of the male insert **30** to bring electrical
10 power to the male insert **30** when the male insert **30** is inserted into a socket **52** of a lighting string **46**.

 According to one aspect of the present invention depicted in **FIG. 4**, the male insert **30** includes a universal husk **66** that enables the male insert **30** to fit inside various standard lighting string sockets **52**. The husk **66** and base **64**
15 may form a single integral component or may be separate pieces joined by various means known to those of skill in the art. The universal husk **66** includes at least one resilient tab **104** for enabling the male insert **30** to fit snugly inside a socket **52** of a conventional lighting string **46**.

 In some variations, the resilient tab **104** includes a fixed end **108** flexibly
20 attached to and extending angularly from the husk **66**. In some instances, the tab **104** is attached to and extending angularly from the insertable end **70** of the male insert **30**. The tab **104** is flexibly affixed to the husk **66** such that it is sufficiently resilient to undergo multiple insertions and removals. Thus, upon application of a biasing force, the tab **104** deflects in a direction toward the
25 husk **66**. Upon removal of the biasing force, the tab **104** protrudes in a direction away from the husk **66**.

Where more than one tab **104** is present, for example, where two tabs **104** are present (**FIG. 4**), the tabs **104** may be positioned on the husk **66** so that the tabs **104** are in a coaxially aligned spaced apart relation on opposing sides **110a** and **110b** of the husk **66**. As above, the tabs **104** may be attached to and
5 extending angularly from the insertable end **70** of the male insert **30**.

Each tab **104** is flexibly affixed to the husk **66** at one end **108** and sufficiently resilient to undergo multiple insertions and removals. Thus, upon application of a biasing force, each tab **104** deflects in a direction toward the opposed tab **104**, and upon removal of the biasing force, each tab **104**
10 protrudes in a direction away from the opposed tab **104**.

Thus, as the male insert **30** is inserted into the socket **52**, the resilient tabs **104** are subjected to a biasing force upon contact with the socket **52**, thereby causing the tabs **104** to deflect in a direction **X** toward the opposed tab **104**. When the male insert **30** is fully inserted into the socket **52** and the biasing
15 force is removed, the tabs **104** tend to deflect away from the opposed tab **104**. This enables the male insert **30** to be securely held in position inside the socket **52**.

The resilient tab **104** may be made of any suitable material, such as a polymer, metal, or the like, provided that the material possesses sufficient flex
20 characteristics at the desired tab **104** dimensions. Further, the tab **104** may have any thickness, provided that the ability of the tab **104** to deflect during insertion and removal of the male insert **30** is not impeded. In some embodiments, the tabs **104** are formed from sufficiently flexible plastic using molding techniques known to those skilled in the art. Alternatively, the tab **104** may be constructed
25 of various components joined together thermally, adhesively, by solder, or the like.

Whether the tab **104** possesses sufficient flexibility is governed by fundamental principles of mechanics. The resilient tab **104** will be deflected multiple times during insertion and removal of the male insert **30**, so it is imperative that the strain on the tab **104** does not exceed the maximum allowable dynamic strain on the particular material. Strain on the tab **104** is a function of both the dimensions of the tab **104** and its ability to deflect. Methods of calculating strain on the tab **104** are well known to those of ordinary skill in the art. The maximum allowable dynamic strain for a given material is readily available from the material supplier and is often presented as a stress-strain curve. Suitable materials for the present invention may include, but are not limited to, various polymers, metals, composite materials, and so forth.

An additional consideration in designing the resilient tab **104** is whether a fillet radius should be used at points of high stress. A sharp corner at the juncture between the tab **104** and the husk **66** may be a point of high stress (when inserting and removing the male insert **30**) at which yielding or breakage may occur. Use of a fillet radius may help to alleviate the stress and extend the life of the tab **104**.

Where a universal fit husk **66** is not provided with the article **20** of the present invention, and the husk is not dimensioned to properly fit within the socket **52** of a conventional lighting string, the article **20** may be provided with a removable husk **106**. Thus, according to another aspect of the present invention depicted in **FIGs. 5A-5B**, the illuminated decorative article **20** is provided with a male insert **30** having a removable husk **106** (**FIG. 5A**) that can be replaced or adapted as needed to enable the male insert **30** to properly fit into the socket **52** of the lighting string **46**. In such instances, the removable

husk **106** may be removed from the male insert **30** and replaced with a light bulb shell **100** (best seen in **FIG. 6**) from the lighting string **46**.

To do so, the wire leads **68** extending from the husk **106** are bent into a linear configuration, and the husk **106** is separated from the base **64** (**FIG. 5B**).

5 After the husk **106** has been removed from the male insert **30**, **FIGs. 6A-6E** depict the manner in which the husk **106** is replaced with a light bulb shell **100** from a conventional lighting string **46**.

First, a light bulb **44** and light bulb shell **100** are removed from a socket **52** of a lighting string **46** (not shown).

10 Next, at **FIGs. 6A-6B** the light bulb **44** is removed from the shell **100** by bending the wire leads **102** into a linear configuration and gently pulling the bulb **44** from the shell **100**.

Next, at **FIG. 6C** the male insert **30** of the lighting assembly **32**, with wire leads **68** in a linear configuration, is inserted into the shell **100**. According
15 to one aspect of the present invention, the male insert **30**, in particular, the base **64**, may include one or more stepped or tapered cylindrical sections (not shown) that allow the base **64** to fit into various different sized shells **100** (not shown).

Next, at **FIG. 6D** the wire leads **68** are bent into an arcuate
20 configuration to lie alongside the surface of the shell **100** and serve as electrical connectors for the lighting assembly **32** (not shown).

Next, at **FIG. 6E** the assembled shell **100** and base **64** are inserted into a light bulb socket **52** on a lighting string **46**, thereby providing power to the lighting assembly **32** (not shown).

25 **FIGs. 7A-7B** illustrate an exemplary lighting assembly **32** that may be used with the present invention. The lighting assembly **32** includes a plurality of light emitting diodes (LEDs) **72a**, **72b**, and **72c** and a supporting base **74**. In

some instances, a circuit board **76** may serve as the base **74** on which the LEDs **72a**, **72b**, and **72c** are supported. The circuit board **76** supplies power to the LEDs **72a**, **72b**, and **72c** and controls the lighting pattern and/or sequence, intensity variation, and power conversion as needed. The circuit board **76** may
5 include driver circuitry configured to turn the color LEDs **72a**, **72b**, and **72c** on and off at a selected frequency, intensity, and pattern to create a pleasing multi-color lighting effect.

According to one aspect of the present invention, the lighting assembly **32** includes a plurality of LEDs **72a**, **72b**, and **72c** supported on a circuit board
10 **76** and a housing **78** that fits within the neck **38** of the enclosure **34**. The housing **78** is preferably a transparent or translucent plastic member. The housing **78** may be formed from one or more plastic components assembled and adhered together using an adhesive material.

Turning to **FIGs. 8A-8C**, a decorative collar **40** that may be used with
15 the present invention is shown. As depicted in **FIGs. 8A-8B**, the collar **40** is at least partially hollow to receive and conceal the components of the lighting assembly **32** positioned inside the neck **38** (best seen in **FIGs. 1** and **3**). The collar **40** further provides an ornamental feature to the decorative illuminated article **20** (**FIG. 1**).

20 The collar **40** is generally cylindrical and includes a substantially planar surface **80**, a tubular surface **82** and an interior space **60**. The tubular surface **82** includes an interior surface **84** and an exterior surface **86**. The exterior surface **86** of collar **40** may include decorative ribbing or knurls, or any other suitable decorative design. The planar surface **80** includes a hole **90** through
25 which the wire **24** is inserted (not shown). According to one aspect of the present invention, the collar **40** may include an arcuate metal hanger **88** that can be used to suspend the decorative illuminated article **20** and the associated

enclosure **34** from a supporting structure, such as a nail, a hook, or a tree branch (not shown).

Turning to **FIGs. 8B-8C**, according to another aspect of the present invention, the collar **40** is generally dimensioned and adapted to engage the neck **38** of the enclosure **34**. Where a threaded gasket **58** is provided on the neck **38**, the collar **40** may include threading **92** on the interior surface **84** (**FIG. 8B**) to engage the neck **38**.

To secure the collar **40** to the neck **38**, the collar **40** is aligned with the neck **38** and rotated in a twisting or screwing manner onto the threaded gasket **58**. While use of complementary threading to engage the collar **40** and the neck **38** is described in detail herein, it should be understood that other means of securing the collar **40** to the neck **38** are contemplated by the present invention. However, use of a threaded collar **40** may be preferred in some instances where the enclosure **34** is particularly heavy or where other support means such as tension-based support means may not adequately support a heavy, yet delicate enclosure.

When the collar **40** is secured to the neck **38** of the enclosure **34**, the planar surface **80** is substantially parallel to the opening **56** of the neck **38**.

Turning to **FIGs. 9A-9D**, the article **20** of the present invention may include a light bulb clip **42**. As is known to those familiar with lighting strings, a light bulb **44** from a lighting string **46** is small and easily misplaced. Removal of a light bulb **44** for use with the illuminated decorative article **20** of the present invention presents a risk of misplacing the bulb **44** removed from the socket **52**. The light bulb clip **42** according to the present invention provides a convenient mechanism to retain a removed light bulb **44** in proximity to the socket **52** from which it was removed for later replacement.

As shown in **FIG. 9A**, the clip **42** generally includes at least two substantially parallel segments **48a** and **48b** joined or connected at one end. The clip **42** includes circular voids **94** with separations or slits positioned along an axis of the voids **94** to allow the plastic to be partially and temporarily
5 separated to receive the wires **24** of the wiring assembly **22** and a light bulb **44**, and firmly hold the bulb **44** in place for later retrieval.

According to one aspect of the present invention, the clip **42** includes a closed end **96**, an open end **98**, and two voids **94a** and **94b** formed by the segments **48a** and **48b** between the closed end **96** and the open end **98**. As
10 illustrated in **FIG. 9B**, the closed end **96** may be used to secure the clip **42** to the wire **24**, while the open end **98** is available to receive a light bulb **44** removed from a socket **52**.

According to another aspect of the present invention shown in **FIG. 9C**, the clip **42** includes a closed end **96**, an open end **98**, and three voids **94a**, **94b**,
15 and **94c** formed by the segments **48a** and **48b** between the closed end **96** and the open end **98**. In this instance, the void **94c** proximal the closed end **96** may be used to secure one of the two wires used to form the length of wire **24** (not shown), the void **94b** may be used to secure the other of the two wires used to form the length of wire **24** (not shown), and the void **94a** distal the closed end
20 is available to receive a light bulb **44** removed from a socket **52** (not shown).

According to yet another aspect of the present invention depicted in **FIG. 9D**, the clip **42** includes an integral closed end **96** for structural integrity, while the open end **98** includes a slit for receiving the wires **24** and bulb **44** as above. Thus, voids **94a**, **94b**, and **94c** are available for receiving a wire **24** or a
25 light bulb **44**, and void **94d** is closed to enhance the structural integrity of the clip **42**.

The clip 42 may be formed from any suitable material that it sufficiently flexible to enable the segments 48a and 48b to be deflected for insertion of items to be retained, while sufficiently resilient to permit repeated deflection of the segments 48a and 48b without fracture. Examples of materials that may be
5 suitable for use with the clip 42 of the present invention include polypropylene and other thermoplastic materials, spring steel, heavy gauge wire, and so forth.

As will be apparent from the above description and figures and the appended claims, the decorative illuminated article 20 is readily assembled without difficulty. The lighting assembly 32 is sized to fit within the neck 38 of
10 the enclosure 34. Thus, to assemble the decorative illuminated article 20, the lighting assembly 32 is inserted into the opening 56 of the neck 38, the collar 40 is slid toward the second end 28 of the wire 24, and the collar 40 is aligned with the neck 38 and screwed onto the threaded gasket 58 on the neck 38.

The male insert 30 of the wiring assembly 22 is then inserted into any
15 socket 52 on a traditional lighting string 46.

To do so, the desired location is first identified. The bulb 44 in that socket 52 is then removed from the socket 52. The male insert 30 is then inserted into the socket 52. The light bulb 44 removed from the socket 52 may then be placed in the clip 42, where provided, by manually separating the
20 segments 48a and 48b of the clip 42, placing the bulb 44 into a clip void 94, and allowing the segments 48a and 48b to return to their original position. In this state, the segments 48a and 48b of the clip 42 firmly hold the bulb 44 for later retrieval and return to the light socket 52. The clip 42 may be removably attached to the wire 24 so that the clip 42 may be positioned anywhere along
25 the length of the wire 24. This enables the clip 42 and light bulb 44 to be placed in a position along the length of the wire 24 that conceals both from view. Thus, the clip 42 is visually inconspicuous and yet provides a convenient

and effective means of securely storing the light bulb 44 removed from the socket.

When assembled, the LEDs 72a, 72b, and 72c of the lighting assembly 32 are available to illuminate the decorative element 36 contained within the enclosure 34. As stated above, in some instances, the LEDs 72a, 72b, and 72c include a red LED, a blue LED, and a green LED that may be lighted sequentially. The effect is that the decorative element 36 is sequentially illuminated in various colors, thereby creating a pleasing visual effect.

Accordingly, it will be readily understood by those persons skilled in the art that, in view of the above detailed description of the preferred embodiments and articles of the present invention, the present invention is susceptible of broad utility and application. Many methods, embodiments, and adaptations of the present invention other than those herein described, as well as many variations, modifications, and equivalent arrangements will be apparent from or reasonably suggested by the present invention and the above detailed description thereof, without departing from the substance or scope of the present invention. Accordingly, while the present invention is described herein in detail in relation to preferred embodiments, it is to be understood that this detailed description is only illustrative and exemplary of the present invention and is made merely for purposes of providing a full and enabling disclosure of the present invention. The detailed description set forth herein is not intended nor is to be construed to limit the present invention or otherwise to exclude any such other embodiments, adaptations, variations, modifications, and equivalent arrangements of the present invention, the present invention being limited solely by the claims appended hereto and the equivalents thereof.